NEW CADASTRAL APPROACH FOR SUSTAINABLE DEVELOPMENT IN MULTILAYER BUILDING

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ABSTRACT
Cities in State of Penang, Selangor, Kuala Lumpur and Johore have so far absorbed their growing numbers in settlements with a varying quality of living and the complexities of the extreme modern buildings are expected to be designed and built in the near future. Unfortunately, the existing Malaysian Cadastral System and legislation for 2D parcel is unsuitable for representing the land rights in 3D situations for those rapid increases for development and technical purposes. Hence, an efficient 3D land use in real estate property especially for multilayer objects is directly linked to the socio-economic and environmental development in Malaysia.

This paper describes the overview of Malaysian Cadastral System for 3D purpose and the situation in Malaysia. We explain the current practice of cadastral registration in Malaysia and elaborate more about Malaysian Cadastral Data Model. The Malaysian Digital Cadastral Database, Computerised Land Registration System and Cadastral Data Management System, the development of 3D Cadastre registration and the integration of CLRS and CDMS are illustrates respectively.

Throughout the paper it is hope that this new approach can bring to planning and construction sustainability in Malaysia.

KEYWORDS
land administration, 3D, legislation, cadastre, property rights.

1. INTRODUCTION

The urban population in Asia has increased by 550 million people during 1960-1990 and are expected to increase by 1,286 million people by year 2020 (Ji, 2007). Since late 1990s, the population of Malaysia has increased from approximately 21.80 million to 27.73 million in 2008 (Statistic, 2008) and it is predicted to reach 31 million by 2020. Therefore, a systematic record of lands matters involving registration of the details of transaction, such as transfer of land and interest, lease, charge, releasing of easement and change of condition of the land is very important in land administration, planning and development. As stated in UN-ECE (1996), land administration consists of a Cadastral Survey and Mapping Registration System, and a Land Registration System. These two systems are very important for the formation of a good Land Administration System. A cadastral system is an information system consisting of a series of maps or plans showing the size and location of all land parcels together with text records that describe the attributes of the land. This 2D Cadastre system is adopted by many countries in the world

including Malaysia because the system provides essential information about land and property such as ownership of the lot and land parcel for the country.

2. OBJECTIVES

In view of the Malaysian Cadastral System that is based on the 2D cadastre, the purpose of this paper is to give an introduction onto limitation on private and public properties. Here, we identified some problems and constraints in current Malaysia Cadastral System for registration of 3D cadastral parcel. We explain the development, cadastral map and land title situation in Malaysia. This paper also shows the current cadastre registration system in Malaysia, the Malaysian Cadastral Data Model and Database. Finally, 3D cadastre registration development and the possibility of integration of Computerised Land Registration System and Cadastral Data Management System will be illustrated here.

3. PROBLEMS AND CONSTRAINTS IN CURRENT MALAYSIA CADASTRAL SYSTEM FOR MULTI-LEVEL BUILDING

In the last couple of decades, there has been a demand in urban areas for dividing ownership in buildings so that different owners can own different parts or can own a delimited space on, above or below ground surface. When regular utilisation of space above surface started for high rise constructions and aviation, it brought forth the question regarding whether such space could be subdivided into separate units for ownership had to be discussed (Sandberg, 2003). There are many complex situations in urban society in which there are multiple uses of space (Stoter and Ploeger, 2002). This has caused an emergence of situations where the vertical dimension is an important factor for real property objects. It has also resulted in the pressure of extending human activity on the lands that are densely populated areas, resulting in competition for space and creating environmental problems (Paulsson, 2007).

The development above and below ground surface can be facilitated by guaranteeing the property rights of owners. It is also believed that 3D registration of proprietary rights promotes investment in such development projects (Doytsher, Forrai and Kirschner, 2001). The interest in urban areas for using land above and below ground is often connected with investors who are interested in making rights more secure and transferable (Paulsson, 2007). This is similar to Malaysia land

tenure title registration system where the register contains rights, restrictions and responsibilities about the proprietor. As a result, different rights, restrictions and responsibilities may exist in an integrated 3D property objects, hence resulting in the difficultly of any decision-making on a lot. However, not all restrictions and imposed conditions are stated clearly in the register as there are some that are provided by law and have to be complied by the proprietor.

3.1. The Problems

In Malaysia, there is a lack of proper legislation regarding 3D property in land and cadastral law to cater for the registration of any related legal and technical aspects. Many conflicts seem to exist between laws and statutes with the current cadastral status. Therefore, the rights associated with this registration should be clear in the registry titles issued. For example, Strata Title Act 1985 (Act 318) & Rules and Order allows land to be subdivided into parcels or land parcels based on the area occupied, and National Land Code (Act 56 of 1965) & Regulations allow air space rights above ground surface up to a maximum of 21 years in form ranging from an absolute conveyance to splitting off individual rights associated with the air space parcel. This is always used in a complication urban multi-level mix development, or in the allocation of property rights concerning underground facilities in large urban areas (Mitrofanova, 2002). There are currently many arguments about the surface under different categories of land use, subdivision, partition and amalgamation; these arguments would evidently be different if 3D property rights are used. Without the possibility of using 3D properties, other legal rights have to be used to allow separate parties to use different parts of one building or property. To make such rights possible, different and new legal institutions have to be created, such as mineral and air rights (Sandberg, 2003). Again, 3D property rights can take on different forms and can vary from full ownership to rights of different extents (Paulsson, 2007).

3.2. The Constraints

The Malaysian property market has not been operated accordingly with the value of real property depending on its location and parcel area (length x wide) without volume (height). Hence, the price of the parcel unit is based on the specific area and not the volumetric areas as well. The parcel areas in the Final Titles are based on the area given in Certified Plan after the final survey has been completed, this is

exemplified by the calculation of share unit in strata title for strata and stratum objects. Low cost flats and medium cost flats are usually lower in cost and height than apartments and condominiums; however, if the parcel areas are same, it means that the apartment and condominium owners are paying less money on the assessment, quit rent and maintenance fee which reflects the cost for low and medium cost flat owners.

4. CADASTRAL MAP AND LAND TITLE

Cadastre is a technical term for a set of records showing the value and ownership of land parcel. It provides precise description and identification of particular pieces of land and its acts as a continuous record of rights in land. Meanwhile, a modern cadastre normally consists of series of large scale cadastral map and corresponding register. Both the maps and registers may be stored in computers, such as Cadastral Database Management System (CDMS) and Computerised Land Registration System (CLRS) in Malaysian Cadastral System.

After final survey of an individual parcel of land or a number of lands, a cadastral map or better known as Certified Plan in Malaysia will be produced for those plot/plots of land. Certified plan is prepared following the format determined by the Department of Survey and Mapping Malaysia (DSMM). It shows the lot boundary in various scales with a given Certified Plan number. Information pertaining to the lot location, number, area, bearing and distance are also displayed. Immediate after the approval of Certified Plan, the document of title, such as Registry Title and Land Office Title in Malaysia will be prepared, approved and issued to the owner. Registry Title means title evidenced by a grant or State lease or by any document of title registered in a registry under the provisions of any previous land law while Land Office Title means title evidenced by a Mukim grant or Mukim lease or by any document of title registered in a registry under the provisions of any previous land law. Meanwhile, the digital Registry Title and Land Office Title can be obtained in B1.tiff format.

Unfortunately, these Certified Plan, Registry Title and Land Office Title mostly only represents the surface level of ground with individual land parcels by 2D boundaries, descriptions, rights, restrictions and responsibilities. These conventional 2D map and title display geographical data and is vital for revealing spatial relationships and

patterns (Ji, 2007). However, it has difficulties to record and display the multiple uses of lands with the construction above and below the ground surface.

5. CADASTRE REGISTRATION SYSTEM IN MALAYSIA

The traditional cadastre registration system that is practiced in Malaysia are parcel bounded system with 2D nature and provide essential lands and properties information of the lots and land parcels (Hassan, 2008). Furthermore, Valstad (2006) points to the fact that traditionally land has been described and registered into 2D and all cadastral systems of the world are in fact 2D nature.

The current Malaysia Cadastral Registration System does not consist and includes 3D objects registration and 3D rights as well, but this current system is more similar to land administration system. As stated in (Tan, Hussin and Ernest Khoo, 2009), land administration consists of Cadastral Survey and Mapping Registration System and Land Registration System where both of them contain a set of records about land. This type of 2D Cadastre system being practice in Malaysia for a period of one hundred years and it provides essential information about land and property like ownerships of the lots and land parcels for the country. In Malaysia, the cadastral system is managed by three main authorities namely Department of Survey and Mapping Malaysia, State Land and Mines Office (PTG) and District Land Office (PTD). In general, cadastral survey and mapping is under the jurisdiction of DSMM where it responsible for carrying out land survey and mapping, then follow by registration of cadastral objects there are lots and land parcel boundaries while the later two authorities are responsible for the land title registration (Registry Titles and Land Office Titles).

In Malaysian Cadastral System, there are two systems namely Cadastral Database Management System (CDMS) and Computerised Land Registration System (CLRS) which operated by DSMM and PTG as well as PTD. The CDMS database stored land attributes, spatial objects and other things while the CLRS database stored land ownerships, land tenures and so on, but these two systems works separately in each organisation with difference legal aspect and still in nature of 2D. This mean, there are no 3D object property rights as well as 3D cadastral rights. These two systems later on can be incorporated in the registration form with the present advance and modern technologies such as GIS, internet, web based and e-commerce applications. Figure 1 shows the current system with the proposed

concept of legal aspect for 3D objects registration and visualisation rights as well as 3D property rights.

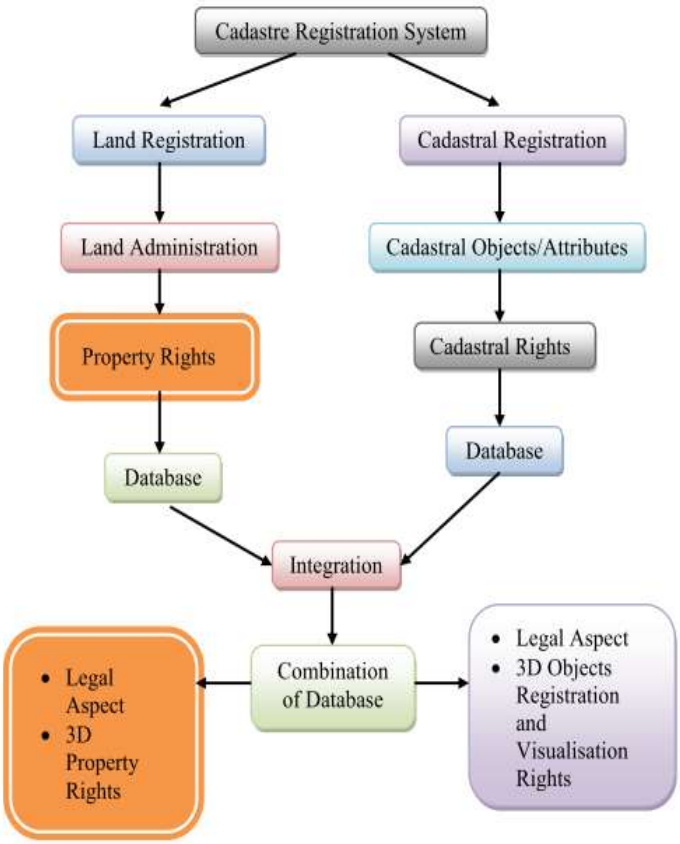

Figure 1: Current cadastral system with proposed concept of rights

6. MALAYSIAN CADASTRAL DOMAIN MODEL

The Core Cadastral Domain Model (CCDM) which introduced in the current version of model (Van-Oosterom *et al*., 2006) mentioned that this model is the foundation of most land administration and is designed for various land registration system and cadastral system all over the world and as a base for all cadastral registration. In other words, the relationship between the three core classes in the Unified Modelling Language (UML) diagram as in Figure 2, there are Person (subject), RRR (right, restriction, responsibility) and Register Object (real property objects), can used to illustrate Malaysia Cadastral Data Model.

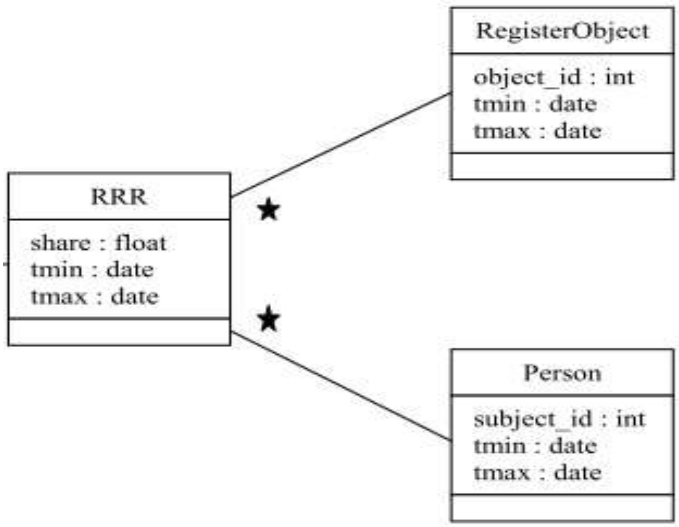

Figure 2: UML class diagram of CCDM: (Adapted from Stoter, 2004; Van-Oosterom et al., 2006; and Chong, 2006)

7. MALAYSIA CADASTRAL DATABASE

The arrival of computer and the rapid development of Information Communication Technology (ICT) has resulted widespread technological reforms in the field of cadastral system and in line with the government objective of providing efficient and quality land administration services to the public. Realising the importance and potential of this new technology, DSMM and PTG had initiated their computerisation programme in the early 1980's and 1990's respectively. The most significant change that ICT has brought about is that the shift from conventional analogue data to digital data and consequently the introduction of the concept of digital database which forms the base component of a Land Information System (LIS) which in turn has been identified as having an indispensable role in the process of decision making in resource management and planning. For example, PTG has computerised two of its main operations in land administration named Computerised Land Registration System and Land Revenue Collection System to cater the land registration and revenue collection activities. On the other hand, DSMM has implemented a data collection and processing facility named Cadastral Data Management System for cadastral activity, the Computer Assisted Topographic Mapping for mapping activity and also the Automated District Survey Office System for district survey office activity, and then both CLRS and CDMS enabled the process of land registration and measurement of ownership to be accelerated (Chong, 2006).

The CDMS will provide a network for the survey department to access the Digital Cadastral Database (DCDB) and the digital image library from any personal computer within the network, with a single window and single point of access. DCDB holds digital cadastral base maps that are used for building up Geographical Information System (GIS) and land related applications, while the image library holds scanned and indexed certified plans stored in the disk arrays at every state survey departments. CDMS is also capable of receiving orders from clients through remote access, e-mail, dial-up and other things as well as providing an automatic invoicing, billing and accounting system and it also cater for remote access to and from the District Survey offices (JUD). A system which forms part of the CDMS that is Quality Assurance System is a module to preserve the integrity, and accuracy of the DCDB.

With the implementation of the CLRS, a system to modernise and to facilitate the registration of land title and dealings, data are extracted from both the documents of title and other land related documents. Meanwhile, the information in the CLRS database are based on the records kept in the land registers and relevant files with include information on ownership (Person), land identification (Register Object), restriction and record of dealings. As mentioned by (Chong, 2006), the register furnishes all information pertaining to the ownership (person), the land (object) through description of area and location and boundary limits from the Certified Plan and rights (details of encumbrance, expressed conditions, caveats and prohibitory orders and other things). However, not all restrictions are stated in the register, some are implied by law for example National Land Code (Act 56 0f 1965) & Regulations, planning control and so on.

8. 3D CADASTRE REGISTRATION DEVELOPMENT IN MALAYSIA

The development of 3D Cadastre registration are more on technical part where researchers study on the process of adding 3D Cadastre objects in the current cadastre data model and information accessible among DSMM, PTG and PTD, unfortunately the two state database which are DCDB and CLRS database works separately in different authorities and still in 2D situation. As mentioned in this research previously, Malaysia land administration are based on the Torrens system where Cadastral Map and legal document with spatial and textual information as a legal evident under the rules and regulations are needed in order to have fully institutional coordination.

The 3D Cadastre objects such as strata building, construction on, above and below the ground surface, i.e. underground tunnel, metro station, skywalk and other things is a real property object that being built on the 2D land parcel, which are the responsible by PTG, PTD and DSMM on the ownership registration and object registration respectively. Apart from this 2D land parcel, there is also a 3D land parcel, which is similar to 3D physical object based on the hybrid solution by (Stoter 2004), together form from the Register Object, where the 2D land parcel is represented as a 2D geometry while 3D land parcel is form with 2D geometry and 3D information. Furthermore, the 2D land parcel is inherited from the current registration system that is the cadastral lot that consists of boundary lines and boundary marks. On the other hand, 3D land parcel is projected with the 3D bounded space that consists of face, node and vertex with list of coordinates that form flat faces and forming of 3D objects which better known as 3D Cadastre object later. The combination of this concept data model can be shown in Figure 3.

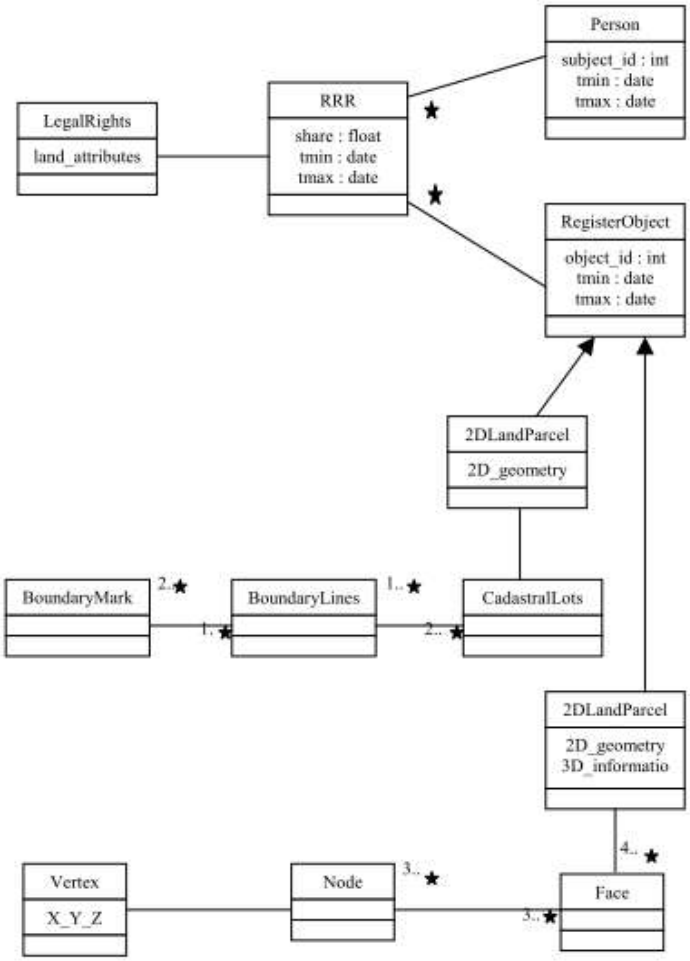

Figure 3: UML class diagram of 3D cadastre registration concept data model (Partly adapted from (Ahmad-Nasruddin and Abdul-Rahman, 2006)

9. INTEGRATION OF COMPUTERISED LAND REGISTRATION SYSTEM (CLRS) AND CADASTRAL DATA MANAGEMENT SYSTEM CDMS)

There could be extensive benefits if these two systems, which are CLRS of PTG and CDMS of DSMM, are linked together. For that reason, a pilot project being started in Kuala Lumpur in 1st April 1995 to electronically connect and integrate the CLRS with the CDMS for the whole Kuala Lumpur then to develop the operational systems that can subsequently be implemented throughout the country in Peninsular Malaysia. Therefore, with the integration of attribute data from CLRS and spatial data from CDMS and through identified application, efficiency of land administration can be greatly improved. Nordin (2001) stated that the envisaged applications include on-line registration for survey and preparation of title, extending DCDB enquiry module to the land administrators and on the hand, linking the Qualified Title (QT) information to the DCDB. Although conceptually tenable, the eventual implementation would need substantial negotiation and compromising in between PTG and DSMM.

With the vast changing in the ICT, such as GIS, internet and web based application and together with the initiative of Malaysian Geospatial Data Infrastructure, that is National Spatial Data Infrastructure, e-Tanah of Ministry of Natural Resources and Environment as well as e-Cadastre, Electronic Strata Module of DSMM, CLRS and CDMS database could be integrated electronically. In order to achieve the goal of comprehensive Land Information System from district level up to state and eventually at the national level, the integration of spatial CDMS database with the textual CLRS database play a preliminary requirement of all these. Moreover, Mariappan (2005) introduced a mechanism to integrate these two standalone databases. Coordination among DSMM, PTG and PTD can be provided by the installation of centralised server or distributed server at each of their office which act as the transporters and bridges in exchanging data between CLRS and CDMS. Figure 4 illustrates the conceptual integration of cadastral survey and title registration databases. Although there are a lot of benefits from an integrated textual title registration database and the graphic as well as spatial cadastral database, but there are still many hurdles to solve at this stage.

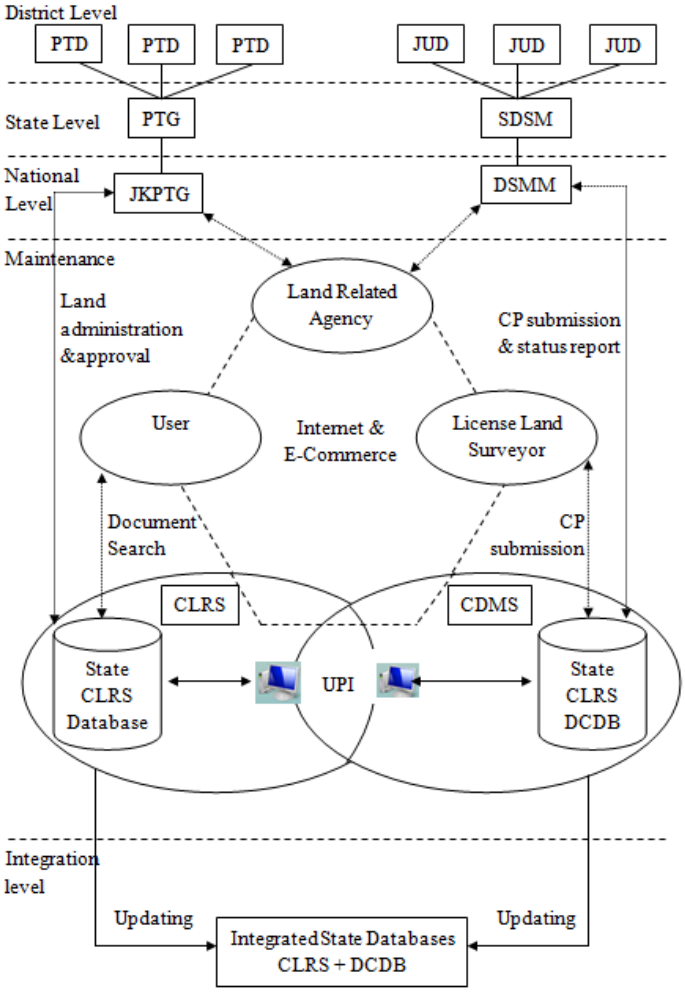

Figure 4: Conceptual model to integrate CLRS and DCDB (Partly adapted from Mariappan, 2005)

10. CONCLUSIONS

In conclusion, there are many aspects to consider in implementing the 3D property rights of a legal and technical nature. Among these aspects, the core of this research attempt to investigate problems occurs in the Malaysia cadastral system on the legal aspect which can be seen as a foundation for 3D property and its technical aspect. The main legal documents involved are National Land Code (Act 56 of 1965) & Regulations, Strata Title Act 1985 (Act 318) & Rules and Order, and Building and Common Property (Maintenance and Management) Act 2007 (Act 663). Without proper land and cadastral legislation, such property cannot be formed at all. As a result of this, it has also been necessary to look into the legal systems of other countries, where 3D property formation is already possible by law, and to gain information about what kind of problems are faced there and how they have handled; this is so as to better understand the problems that may occur for countries

introducing 3D property rights into their legislation. For this reason, the Swedish Land and Cadastral Legislation is used as the legislation model in this research. In regards to the technical aspects, the references above were used for designing appropriate methods as they would be the fundamental principles applied to cadastral survey and mapping practices.

In Malaysia, the main thing that hinders the progress has been the national legal system because there are no provisions and there is a lack of proper Malaysia cadastre law to cater for the registration of legal and organisational aspects for 3D cadastral parcel in full 3D Cadastre as described by (Stoter, 2004). Therefore, the legal profession is always very conservative because they are attached to the old and traditional land registry law and legal changes generally take quite a long time to change.

This paper is part of the research on developing a 3D property registration system in Malaysia. As mentioned earlier, besides this technical aspect, legal and organisational aspects also play an essential role and cannot be ignore or separated from the cadastre main body, therefore, all of these aspects should work together and concurrently. In short, this paper can be an initial start for research on the legal and organisational aspects for developing Malaysian 3D Property Registration System.

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